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## Multiple potential payers and sovereign bond prices

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SEEMHN

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## Editorial

The South-Eastern European Monetary History Network (SEEMHN) is a community of financial historians, economists and statisticians, established in April 2006 at the initiation of the Bulgarian National Bank and the Bank of Greece. Its objective is to spread knowledge on the economic history of the region in the context of European experience with a specific focus on financial, monetary and banking history. The First and the Second Annual Conferences were held in Sofia (BNB) in 2006 and in Vienna (OeNB) in 2007. Additionally, the SEEMHN Data Collection Task Force aims at establishing a historical data base with 19<sup>th</sup> and 20<sup>th</sup> century financial and monetary data for countries in the region. A set of data has already been published as an annex to the 2007 conference proceedings, released by the OeNB (2008, Workshops, no 13).

On 13-14 March 2008, the Third Annual Conference was held in Athens, hosted by the Bank of Greece. The conference was dedicated to *Banking and Finance in South-Eastern Europe: Lessons of Historical Experience*. It was attended by representatives of the Albanian, Austrian, Belgian, Bulgarian, German, Greek, Romanian, Russian, Serbian and Turkish central banks, as well as participants from a number of universities and research institutions. Professor Michael Bordo delivered the key note speech on *Growing up to Financial Stability*. The participants presented, reviewed and assessed the experience of SE Europe with financial development, banking and central banking from a comparative and historical perspective.

The 4<sup>th</sup> Annual SEEMHN Conference will be hosted by the National Serbian Bank on 27<sup>th</sup> March 2009 in Belgrade. The topic of the Conference will be *Economic and Financial Stability in SE Europe in a Historical and Comparative Perspective*.

The papers presented at the 2008 SEEMHN Conference are being made available to a wider audience in the Working Paper Series of the Bank of Greece. Here we present the second of these papers, by Kim Oosterlinck and Loredana Ureche-Rangau.

June, 2008

Sophia Lazaretou  
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# **MULTIPLE POTENTIAL PAYERS AND SOVEREIGN BOND PRICES**

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## **ABSTRACT**

Sovereign bonds are usually priced under the assumption that only the sovereign issuer may be responsible of their repayment. In some cases however, bondholders may legitimately expect to be repaid by more than one agent. For example, when a country breaks-up, successor states may agree to recognize their responsibility for part of the debt. Other extreme events, such as repudiations, may lead (and have led) bondholders to consider several bailout candidates at the same point in time. This paper first discusses the theoretical financial implications stemming from an infrequent and challenging situation, namely the existence of multiple potential payers. Then, through a historical precedent, the 1918 Russian repudiation, the paper confirms that the existence of multiple potential payers has a diversification effect which lowers the volatility of the bond price and increases its value. These results are strengthened by a comparison with a closely related standard case of default.

*Keywords:* Sovereign bonds; Repudiation; Default; Portfolio diversification; Multiple payers; Russia; Romania; Financial history.

*JEL classification:* F34; G15 ; G33 ; N20 ; N24.

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## 1. Introduction

Sovereign bonds are unique financial assets because of the nature of their issuers. In the absence of an international recognized body acting as a court, bondholders have almost no way to enforce payment on a defaulting country. Nonetheless, countries keep on issuing large amount of debts, bondholders subscribe these and defaults remain, on average, more the exception than the rule. Researchers have therefore attempted to understand the incentives for investors to still subscribe such bonds (Eaton et Fernandez, 1995), the causes of default but also countries' motivations to repay their debts.

According to Manasse, Roubini, and Schimmelpfennig (2003) the main factors leading to default are macroeconomic imbalances and instability, high external debt ratios, illiquidity or refinancing risks as well as policy uncertainty. Eichengreen, Haussman, and Panizza (2003) stress the importance of the "original sin", i.e. the incapacity to borrow in its own currency. Reinhart, Rogoff and Savastano (2003) suggest that countries could become "debt intolerant". They observe that some countries with very low debt ratios still end up defaulting whereas others manage to fulfill their obligations despite huge debt ratios. For some "serial defaulters" countries, defaults have almost become a way of living. The literature on motivations to repay identifies several risks associated to default: reputation loss (Borchard and Wynne, 1951; Fishlow 1985, Eaton and Gersovitz, 1981), penalties or commercial retaliations (Bulow and Rogoff, 1989; Rose, 2005; Mitchener and Weidenmier, 2004), asset seizure and military intervention (Fishlow, 1985; Mitchener and Weidenmier, 2005).

When defaults occur bondholders may always hope to get bailed out by an International Financial Institution or, but this has proved less frequent, by their own government. Eventually, bondholders may hope to get reimbursed by a series of states when an empire (or a country) breaks up. Following the break-up of the Ottoman Empire protracted negotiations started regarding the fate of its debts. Eventually, successor states were each assigned a part of this debt in the framework of the Lausanne Treaty (1924). Turkey's share amounted to 65%, Greece's to 9%, Syria and Lebanon inherited 8%, Iraq 5%, Yugoslavia 4%, Palestine 3%, the remaining part being divided between Bulgaria, Albania, Hedjaz, Yemen, Transjordan, Italy,

Nedjd, Maan and Assyria (Borchard and Wynne, 1951). These elements raise two questions: what is the impact of bailout expectations on default probabilities and how does the existence of multiple potential payers affect sovereign bond prices? The first question is nowadays the subject of intense debates and has led to numerous publications. These will be shortly reviewed in the next section. The second one has, to our knowledge, never been addressed. However, one wonders how the holder of an Ottoman bond should have reacted in the early 1920's. Was the new repartition of the debt among states which would now be considered as having highly different ratings a good or a bad news?

The impact of international official rescues following successive debt problems in a number of developing countries is the subject of an important number of research papers. Typically, International Monetary Fund's bailouts are known to be plagued by moral hazard both for creditors and debtor countries. Whereas IMF lending in crisis situations might encourage investors to excessive risk-taking practices, they can also push sovereign debtors to implement imprudent policies. Empirical evidence on IMF interventions has not managed to bring a clear-cut answer to these questions. Kamin (2004) and Brealey and Kaplanis (2004) find no clear impact of IMF interventions on debt values. On the other hand, another group of research papers (see for instance Dell'Ariccia et al., 2006 among others) analyzes the effects of bailout expectations on sovereign bond spreads in emerging markets and point out the existence of "investor moral hazard". Jeanne and Zettelmeyer (2005) focus on the conditions under which official crisis lending does not have any adverse incentive effects (the "Mussa theorem"). Basically they suggest that IMF lending at an actuarially fair interest rate and debtor governments maximization of the welfare of their taxpayers contribute to avoid any moral hazard. By pointing out the necessary conditions under which IMF interventions do not induce inefficiencies, their paper contributes to establishing potential channels through which moral hazard could in fact appear in practice. Besides IFIs interventions governments have sometimes accepted to bailout their nationals who were holding sovereign bonds in default. Historically, the degree of intervention has widely varied from one country to the other, with Great-Britain showing a great reluctance to bail out their debt holders whereas France or Germany were more willing to help them out (Eichengreen and Portes, 1989).



Historical evidence shows that in some specific cases, notably country break up or repudiations, bondholders could legitimately hope to get reimbursed by more than one actor. The existence of multiple potential payers is highly infrequent and has therefore never been analyzed in depth. This paper proceeds as follows. The next section presents a theoretical model based on modern finance portfolio theory. Notably, it stresses that when multiple potential payers exist, investors may be considered as holding portfolios of negatively correlated assets. A high bailout probability from one potential payer - low probability of non reimbursement - is associated with low bailout probabilities from the other potential payers. The third section describes one of the most salient examples of multiple bailout expectations: the repudiation of Russian bonds by the Bolsheviks in 1918. The data and empirical results are presented in section 4 which also provides a comparison with a standard case of bonds in default, with a single payer.

## 2. Multiple potential payers and bonds portfolio

Several methods may be used to compute sovereign bond prices. A standard model takes into account the expected cash flows and discounts them with an interest rate reflecting the bond risk. An alternative is to discount the cash flows at a risk free rate and then to add in a factor controlling for default probabilities and recovery value in case of default. In this second framework, the bond current value is:

$$V_0 = \sum_{t=1}^N [pDebtort_t * f_t * A] + \sum_{t=1}^N [p_t * f_t * R] \quad (1)$$

with

$pDebtort_t$  = joint probability of no default occurring from issuing date to  $t$

$A$  = constant annuity = coupon ( $c\% * \text{remaining capital}$ ) + principal repayment, i.e.

$$\text{Issuing price} = A \left[ \frac{1}{c} - \frac{1}{c(1+c)^N} \right] \quad (2)$$

$c$  = nominal coupon rate

$p_t = pDebtort_{t-1} - pDebtort_t$  = adjusted risk-neutral probability of default during the specific date  $t-1$  to date  $t$

$f_t$  = risk free present value discount factor

R = recovery value paid immediately after default

As underlined by Cumby and Pastine (2001), this default probability must be considered more as a synthetic measure of the debtor's credit quality rather than as a true (actuarial) default probability. Indeed, interpreting these estimates as true default probabilities requires the implicit assumption that agents are risk neutral and failing to account for risk aversion may generate overestimations of implied default rates.

The underlying hypothesis is that default probabilities computed at a given date remain constant for all the future cash flows following that date. Considering the date  $t$  term risk-neutral probability rate as  $\rho_t$ , then, the probability of a payment at a future date  $t$  becomes

$$pDebtort_t = (1 - \rho_t)^t \quad (3)$$

If there is not bailout expectation and if one further assumes a zero recovery value<sup>1</sup>, then, using equations (1) and (3) bond prices may simply be written as being

$$V_0 = \sum_{t=1}^N [(1 - \rho_t)^t * f_t * A] = \sum_{t=1}^N [pDebtort_t * f_t * A] \quad (4)$$

If there is a **default with one single payer**, equation (4) describes the bond value as only depending upon implicit risk neutral default probabilities and the risk free discounted cash flow. In a more generic form, each future cash flow generated by the bond is a sum of two components, i.e.

$$A * pDebtort + (1 - pDebtort) * 0$$

Suppose now that another agent may be perceived as a potential candidate for the reimbursement. Then, equation (4) must be rewritten as

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<sup>1</sup> This assumption may also overstate true default probabilities.

$$\begin{aligned}
V_0 &= \sum_{t=1}^N [(1 - \rho_t)' * f_t * A] = \\
&= \sum_{t=1}^N [p \text{Debtor}_t * f_t * A + (1 - p \text{Debtor}_t) * f_t (p \text{IFI}_t * A + (1 - p \text{IFI}_t) * 0)] \quad (5)
\end{aligned}$$

where  $pIFI$  is the probability of reimbursement from this external agent. In this case, one assumes that the bailout probability is conditional on default. If one considers the case of a **default with multiple payers** then, the two components of each future cash flow become  $A * p\text{Debtor} + A * (1 - p\text{Debtor}) * p\text{Others}$ .  $p\text{Others}$  measures the probability of other potential payers substituting the original debtor and paying the cash flow.

The probability of the debtor continuing to provide the debt service, i.e.  $p\text{Debtor}$ , is not the same in the two situations, i.e. single versus multiple potential payers. Namely, whenever there is a bailout opportunity the debtor has less incentive to pay the whole amount due, i.e.  $A$ , as there is potentially an institution/a government that may support part of his debt service. This is typically the argument put forward by the advocates of the moral hazard theory in the international financial lending policy of the IMF.

In our case, we may write the following relationship between the probabilities of potential repayment:

$$p\text{Debtor}_{\text{single\_payer}} \geq p\text{Debtor}_{\text{multiple\_payers}} \quad (6)$$

However, if we detail the content of a future cash flow expected by bondholders when there is bailout with two potential payers excluding the original debtor, i.e.  $IFI_1$  and  $IFI_2$  we have

$$\begin{aligned}
\text{Cash\_flow}_{\text{multiple\_payers}} &= \\
&A * p\text{Debtor} + A * (1 - p\text{Debtor}) * pIFI_1 + A * (1 - p\text{Debtor}) * (1 - pIFI_1) * pIFI_2 \quad (7)
\end{aligned}$$

Each future cash flow generated by such a bond may then be seen as the value of a 3-asset portfolio of amounts equal to  $A * p_{Debtor}$ ,  $A * (1 - p_{Debtor}) * pIFI_1$  and  $A * (1 - p_{Debtor}) * (1 - pIFI_1) * pIFI_2$  respectively. Moreover, whenever one probability increases, the two others decrease and *vice-versa*. This portfolio may thus be considered as being composed by three negatively correlated assets. As modern portfolio theory states, diversification, even naïve, improves the risk-return characteristics of any group of assets as a whole with respect to each of them individually. The result is even stronger if the composing assets are negatively correlated. Hence, the higher the number of such potential assets representing potential parts of the debt service to be supported by different payers is, the higher the expected future cash flow. Moreover, as an additional result of diversification, the higher the number of such “fictitious” assets, the lower the risk, i.e. the lower the volatility.

In other terms, **the number of probabilities included in  $pOthers$**  (and their level) plays a crucial role in the amount of each expected future cash flow and by consequent, in the bond value and in its volatility. One could even imagine that whenever the number of expected potential payers substituting the initial debtor becomes important, the effects of diversification become more significant and hence the value of a future expected cash flow generated by a bond in the case of multiple payers may become equal or even superior to that expected by bondholders with only one debtor. Hence, for a number of multiple potential payers large enough, one could imagine the following inequality:

$$Cash\_flow_{single\_payer} \leq Cash\_flow_{multiple\_payers} \quad (8)$$

As a consequence, as bond prices are sums of discounted future cash flows, the same inequality may be written for the bond prices, i.e.

$$V_{0single\_payer} \leq V_{0multiple\_payers} \quad (9)$$

where the value of a repudiated bond with two potential payers has the following form

$$V_{multiple\_payers} = \sum_{t=1}^N [pDebtort * f_t * A + (1 - pDebtort) * pIFI_{1,t} * f_t * A + (1 - pDebtort) * (1 - pIFI_{1,t}) * pIFI_{2,t} * f_t * A] \quad (10)$$

It is then obvious that the bond value at each moment in time can be considered as the value of a portfolio composed by as many assets as the number of potential payers. Diversification then contributes to compensate the specific (idiosyncratic) risks associated to each individual asset and to enhance the total risk-return trade off.

Under the set of assumptions presented above, the presence of multiple potential bailouts should increase the bond price value and decrease their risk. Theoretically, the prices of bonds with multiple payers should, in some extreme cases, stay at a higher level compared to bonds with a single potential payer while their volatility should be lower. Several elements must however be stressed: first, the model assumes that recovery value is equal to zero. This is hardly the case in reality. Second, and as mentioned earlier, cases of multiple potential payers are rare in reality. Third, the model assumes that the bailout will provide a cash flow equal to the whole amount of the discounted cash flow. This is also unlikely. Eventually, negative correlations assume that there is no cooperation among the different potential bailout agents. In view of these limitations, it is no wonder that the implication of multiple potential bailouts goes unnoticed and has almost no effect on bond prices. In order to determine this impact, one would need a series of potential payers perceived as credibly committed by bondholders to view any impact on the price itself. This is exactly the case of the repudiation by the Bolsheviks of Russian bonds issued under the Tsarist regime, which we describe and analyze in the next section.

### 3. The Russian repudiation and its multiple payers

The Bolshevik repudiation has been one of the most dramatic events in modern financial history. In France alone, approximately 12 billions of French francs, representing close to 4.5% of French wealth had been invested in these bonds, mainly for political reasons. A large literature has been devoted to these bonds (Girault, 1973) and their potential reimbursement (Freymond, 1996). More recently, Oosterlinck

(2003) and Landon-Lane and Oosterlinck (2006) have shown that following the Soviet repudiation French bondholders could rationally expect to get reimbursed (or partially reimbursed) by a series of actors. Indeed, bondholders' expectations in the case of the Russian repudiation included either an intervention of the French government (which had already happened in a recent past<sup>2</sup>) to bailout the Russian government and insure the debt service or other different scenarios. Among the plausible scenarios one may consider the following ones:

- 1) A French bailout. This was highly credible since the French government actually bailed out part of the bonds and discussions were held in both chambers up till the middle of the 1920's.
- 2) Countries created on the ruins of the Russian empire, such as Poland or the Baltic States were according to international law, responsible for part of the debt and could have reimbursed part of debt. At some point in time, Ukraine, Poland, the Baltic States and several minor Caucasian states recognized their responsibility for part of the debt.
- 3) Following the revolution several armies (White armies) loyal to the Tsar attempted to oust the Bolsheviks. If the Bolsheviks were overthrown, a new Russian government would probably reimburse the debt. This was indeed stated by the successive rulers of the White Armies.
- 4) The Bolsheviks could come back on their decision and reimburse the Tsarist debts to regain access to the international capital markets. The Bolsheviks suggested reimbursing the debts on numerous occasions during the 1920's.

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<sup>2</sup> Following their repudiation by Juarez, the French government had reimbursed 50% of the Mexican bonds issued by Maximilian. This measure only concerned French citizens and was made because of the high profile the French government had had when these bonds were floated.

- 5) Eventually, a clause included in the Versailles Treaty allowed Russia to ask war reparations from Germany and French investors hoped to get reimbursed in an indirect way (by Germany). This was already mentioned before the peace negotiations (Keynes, 1971) and closely followed by French bondholders (Landon-Lane, Oosterlinck, 2006).

Hence, the price of each Russian bond, taking into account the presence of 5 potential payers could be written as follows:

$$V_0 = \sum_{t=1}^N [pDebt_{or_t} * f_t * A + (1 - pDebt_{or_t}) * f_t * A * [p_{1,t} + (1 - p_{1,t}) * [p_{2,t} + (1 - p_{2,t}) * [p_{3,t} + (1 - p_{3,t}) * [p_{4,t} + (1 - p_{4,t}) * p_{5,t}]]]]] \quad (11)$$

with  $p_i$ ,  $i = 1, 2, \dots, 5$  the probability of each potential payer taking over the debt service.

As pointed out previously, for each future cash flow there is a relationship between the various repayment probabilities. Indeed, the repayment by one party is conditional on the default of another. For example, the French government was unlikely to bailout the bondholders if the White Armies successfully reimbursed them. Thus, whenever the likelihood that one payer would reimburse the debt increased, probabilities of repayment by other parties were affected.

In order to determine the relative importance of each of these elements one may want to see how Russian bond prices reacted following the repudiation and how this reaction compares to a more traditional case of default. In order to do so, the following section tracks an index of Russian bonds following the repudiation and of Romanian bonds which defaulted at the beginning of the 1930's.

## 4. Data and empirical evidence

Our database includes prices of two categories of bonds traded on the Paris Stock Exchange: Russian bonds repudiated in February 1918 and Romanian bonds defaulting in February 1933.

Ideally, the empirical comparison of repudiation and default should be conducted on the same issuer, the same time window and the same market in order to eliminate potential country or time period biases. Since the repudiation lasted for almost 80 years, no historical example matches this requirement. In order to limit the potential bias resulting from the time and country difference, the sample uses very similar bonds. In our analysis, we focus on bonds traded on the same market: the Paris Stock Exchange, where both governments issued significant parts of their public debts. The French market concentrated the major part of the Russian securities, i.e. between 40 and 45% of the sovereign Russian debt at the beginning of the XXth century, totalizing a nominal amount of 11.72 billions in 1914<sup>3</sup>. In the same way, during the 1930ties, France became Romania's major creditor, one third of the total Romanian public debt – domestic and foreign – i.e. approximately 1.02 billion French francs, being subscribed by French investors.

Bonds from both countries exhibit very similar features. Both have gold standard parity, explicit for the Romanian bonds and implicit for the Russian ones<sup>4</sup>. Geographically close, Russia and Romania had both a strong sentimental link with the French public. Furthermore, both issues were made with the blessing of the French government, very sensitive to their important strategic and geopolitical implications. Russian investments were fascinating French investors since the 19<sup>th</sup> century whereas Romania and France always claimed their common Latin roots. Eventually, the time span between the Russian repudiation and the Romanian default is rather small and each of these episodes follows a major extreme event, namely WWI and the great depression.

In the Russian repudiation and the Romanian default, the main difference is the existence of different bailout scenarios. In the Russian case, several potential payers

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<sup>3</sup> The Russian section represented more than one third of the foreign securities quoted on the Paris Stock market and almost 4.5% of the French wealth (Girault (1973)).

<sup>4</sup> This particular feature was deemed very important by the French investors, in both cases mainly individuals.



could be expected to at least partially repay the debt whereas in the Romanian case, investors' only hopes had to rest on the Romanian government<sup>5</sup>.

Our empirical analysis is conducted on the weekly bond prices that were collected from the *Cours Authentiques des Agents de Change*, over a two-year window centred on the event date, i.e. the repudiation date - hence stretching from February 8, 1916 to February 8, 1920 for Russia – and the default date - hence stretching from February 18, 1931 to February 18, 1935 for Romania. For each country a bond index was constructed.

The impact of the presence of multiple payers is analyzed through the price evolution of an index composed of two bonds: the Russian sovereign loans 5% 1906 and 4% 1909. The final use of the principals was to cover general Treasury expenses for the first loan and pay back 5% 1904 Treasury bills and extraordinary budget expenses in 1909 for the second loan. These two loans were quoted on the international financial markets; the first one in Paris, Amsterdam, Brussels, London and Vienna and the second one in Paris, Amsterdam and London. Both bonds were actively traded with issues amounting respectively to 2.250 billions and to 1.4 billions French francs. Most of these bonds were traded in Paris<sup>6</sup> but as the loans were redeemable in different foreign currencies, parities were fixed at issue (and identical for both bonds).

The Romanian bond index is composed by either new issues or ancient issues newly converted and unified. Most of the time, these bonds were considered as first rank debt and provided special guaranties such as the product of some specific public taxes, revenues or government monopolies. The most important loans, both in terms of principal and liquidity on the Paris Stock Exchange, were the 4% 1922 Treasury bills consolidation loan and the two monetary stabilization and development loans 7% 1929 and 7.5% 1931 (both issued by the Autonomous Monopolies House of the Kingdom of Romania)<sup>7</sup>. These three loans along with the two unified consoles 4% and 5% 1929 – issued following the Paris agreement of 1928 concerning former debt

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<sup>5</sup> For a detailed description of the Russian repudiation and Romanian default see Landon-Lane and Oosterlinck (2006), Oosterlinck and Ureche-Rangau (2005) and Ureche-Rangau (2003).

<sup>6</sup> For the first loan, serial numbers help identifying the market on which the loan is traded. As stated by Freymond (1995), 72% of the 1906 loan and 74% of the 1909 loan are traded in France.

<sup>7</sup> These three loans represented 84.53% of the total Romanian debt issues and conversions during the Interwar period.

unification – were the traded bonds in default in 1933. The maturity of these loans ranged from 30 to 41 years.

The two following figures show the evolution of the two bonds indices. Figure 1 depicts the evolution of the index represented by the two Russian bonds over the 1916-1920 period along with the major events that could explain its variations. Figure 2 presents the evolution of the Romanian bond index from 1931 to 1935 and the most important factors influencing its behaviour.

*Insert Figure 1 and Figure 2 about here*

The empirical comparison of the two bond indices is provided in Table 1 and Table 2. Several elements show that the repudiated Russian bonds actually fared better than the Romanian bonds.

First of all, the mean of the Russian index is significantly higher than the mean of the Romanian index (see Table 1). On the other hand, the volatility is higher for the Romanian bonds. The maximum and minimum values of the Russian index are superior to those of the Romanian index; for the minimum, the Russian one is twice as large as the Romanian one. The return series for the Russian bonds are much higher than for the Romanian ones. The mean of the Romanian bond returns is the only one being statistically negative. These results indeed stress the fact that Russian bonds show a better risk-return trade-off with respect to Romanian ones, i.e. they are “dominant” assets from the risk-return point of view.

*Insert Table 1 and Table 2 about here*

Table 2, which provides descriptive statistics for both the Russian and Romanian indices after the repudiation and default, confirms these results.

The same conclusions hold whether one considers the whole period or only the two years following the event. Noteworthy, the Romanian index reaches its maximum

value on the reference day. In other words, the prices are following a continuous downward trend as soon as the default is announced. On the contrary, the Russian index is higher than the reference level at several dates during the studied time period and remains at these high levels.

Intuitively, Romanian bond prices, accompanied by a promise of pay back negotiated in the different debt agreements and by the payment of a variable part of the coupon, should remain higher than Russian bond market prices. Moreover, the comparison of the financial characteristics of the two categories of loans is always in favour of the Romanian bonds (see Table 3).

*Insert Table 3 about here*

The theoretical framework introduced in the previous section explains these counterintuitive results. Generally speaking, the Romanian default is a standard one-payer case. Once the default was declared, negotiations started and opened the door to a series of settlements fixing the amount of each future cash flow. In a systematic way, the maximum amount paid by the Romanian government to its bondholders was represented by the minimum percentages of coupon payments stipulated by the debt agreements, even though each agreement stipulated a “normal” debt service immediately following its maturity. Cash flows effectively paid were always revised downward.

The theoretical framework introduced in the previous section allows us to compute the implicit risk neutral default probabilities out of the recorded market prices of the Romanian bonds. Their evolution experiences a continuous increase, accounting for the decline observed on market prices as illustrated in Figure 3.

*Insert Figure 3 about here*

Unlike in the Romanian case, there is no way to directly compute the various probabilities for the Russian index. Indeed, there are five potential payers associated

to five possible financial outcomes as shown in equations (11). Even though there is no way to determine the exact probabilities, it is possible to suggest figures for each of them at some points in time.

Indeed, if one ignores discounting and considers each individual probability as being the probability to get a 100% reimbursement either by the debtor, i.e. the Soviet<sup>8</sup>, or by another payer, then the upper bound of the Russian bond price may be estimated as follows:

$$\text{Bond price} = p_{Sov} * 100 + (1 - p_{Sov}) * [p_{Whi} * 100 + (1 - p_{Whi}) * [p_{Sec} * 100 + (1 - p_{Sec}) * [p_{Ger} * 100 + (1 - p_{Ger}) * [p_{Fran} * 100 + (1 - p_{Fran}) * 0]]]] \quad (12)$$

with  $p_{Whi}$  the probability of a bailout by the White Armies,  $p_{SEC}$ , the probability of reimbursement by a seceding country,  $p_{Fran}$ , the probability of a French bailout and  $p_{Ger}$ , the probability of a German bailout.

Even if one was highly optimistic,  $p_{Sov}$  (the probability of a Soviet reimbursement), as well as  $p_{Whi}$ , were probably very small during most of the studied period. Indeed, even if there had been a desire to repay the debts, the state of the Russian economy was such that repayment would have happened only in a very distant future. At best one may consider  $p_{Sov}$  to be equal to 1% and  $p_{Whi}$  to 5%. Regarding the repayment by Germany, hopes were probably also limited: Germany would soon default on its foreign loans and the probability of repayment of the Russian debts probably never exceeded 1%. On the other hand, seceding countries agreed to recognize their responsibility for part of the Russian debts. According to Delaisi (1930), Poland, Romania, the Baltic States agreed to recognize, in the 1920's, 25% of the former Russian debt.  $p_{Sec}$  may thus be estimated to be close to 25%. Eventually, the French government had previously bailed out its citizens after repudiation. Following the repudiation of bonds issued by Maximilian in Mexico, the French government agreed to bail out its nationals to the extent of approximately 50% of the invested amounts when the new regime ruled by Juarez repudiated these bonds in 1867. The French intervention was at the time motivated by the high profile it had

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<sup>8</sup> This may be viewed as an aggregate probability, in other words if the Soviets may be expected to repay on average 5% of par value then we consider that there is a 5% probability that a 100% will be repaid.

shown when these bonds were floated on the Paris bourse. It is therefore rational to consider  $p_{Fran}$  equal to 50%<sup>9</sup>.

If one replaces these probabilities in equation (12), one finds that the upper boundary for the bond price, i.e. a potential recovery value, is 65.08% of par value, a very close match to the observed maximum price in terms of par value (see Landon-Lane Oosterlinck, 2006).

In a sense, equation (12) implies that each future expected cash flows could be viewed, on the Russian bond case, as a portfolio of five bonds with a negative correlation. As stated by traditional portfolio theory, a portfolio is always characterized by a better risk-return trade off than individual assets, the diversification process contributing to increase expected returns and decrease risk/volatility. As such, a Russian repudiated bond, viewed as a portfolio of different potential cash flows coming from different potential payers, in which risks compensate each other, presents high return and/or low volatility compared to the single debtor Romanian bond in default<sup>10</sup>.

## 5. Conclusion

When bondholders hope to get bailed out, they usually consider only one potential candidate to bail them out. In very extreme and seldom occurring cases, several agents may be viewed as potential rescuers. This is often the case when country break up. In this case, successor states are usually assigned part of the debts. The break up does not necessarily concern an empire. One may indeed consider the potential fate of the Belgian or Canadian debts if Flanders or Quebec managed to secede. Another prime situation for the existence of multiple potential payers is repudiations, i.e. the non recognition of the legal character of the debt. Repudiations

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<sup>9</sup> This hypothesis also goes in the line with French Senator De Villaine's proposal, on October 20, 1922. Arguing the responsibility of the French government and the French banking system for intensively supporting Russian bonds subscription and providing wrong information on their credit quality, Senator De Villaine proposes that bondholders' reimbursement should account for 50% of the nominal value, equally split among the government and the banks involved. Hence, we could even consider a 6<sup>th</sup> potential payer for the Russian debt, namely the French banks.

<sup>10</sup> The fact that our empirical evidence is provided on bond indices instead of individual bonds strengthens even more our conclusions. As indices are already diversified portfolios and the Romanian one contains even more bonds than the Russian one, at the level of an individual bond, the price and volatility differences in favour of the Russian bonds is even higher. Hence, the implicit diversification mechanism embedded in each Russian bond has indeed a significant impact on prices and volatilities.

usually follow extreme political changes. By refusing to respect the debt issued by the former regime, the new authorities stress its predecessor's illegal or odious nature. In this case, potential payers often include the opponents of the “repudiating” regime, but may also include IFI's or countries where the bonds were first issued.

In the case analyzed here, the difference between repudiated bonds and bonds in default may be explained by a simple “implicit” diversification mechanism. When multiple potential payers exist, bondholders must consider the conditional probability of being repaid. In a sense, bondholders can view their bonds as a portfolio consisting of as many bonds as potential payers. These bonds however have a negative correlation since if one payer reimburses the bond others are unlikely to do so. This approach explains the relative high value of the repudiated bonds as well as their lower volatility when compared to the bonds in default.

Our results also show that the debate on the role of institutional interventions, especially operated by the IMF, during financial crisis caused by sovereigns stopping their debt service, is far from being closed. These interventions indeed may induce some moral hazard both in debtor and creditor attitude towards risk but they also may allow a certain diversification of risk sources that maintains bond prices at a higher level than sovereign bonds with a single potential payer.

This comparison of repudiated and defaulted bonds opens a more general question regarding the way financial markets perceive different events. Looking at our results, one could then even wonder if, at the end, a political revolution is not considered by financial markets as more probable to be reversed than an economic crisis. One can indeed imagine that revolutions, state blows or political regime changes can be very sudden, whereas rebuilding up a country's economy generally asks for a longer time.

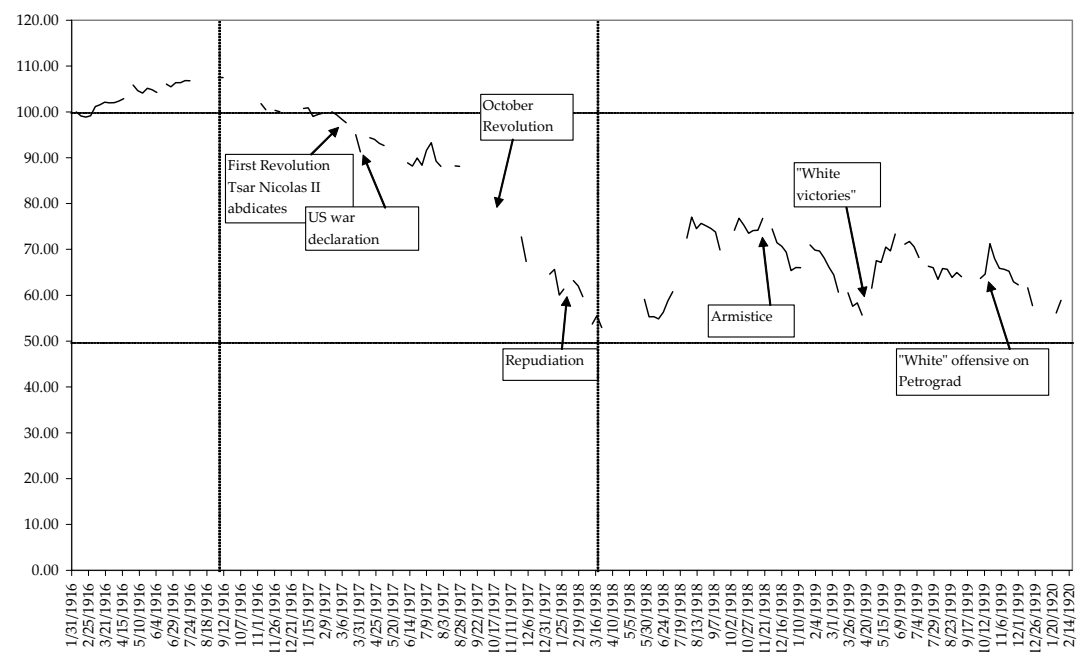
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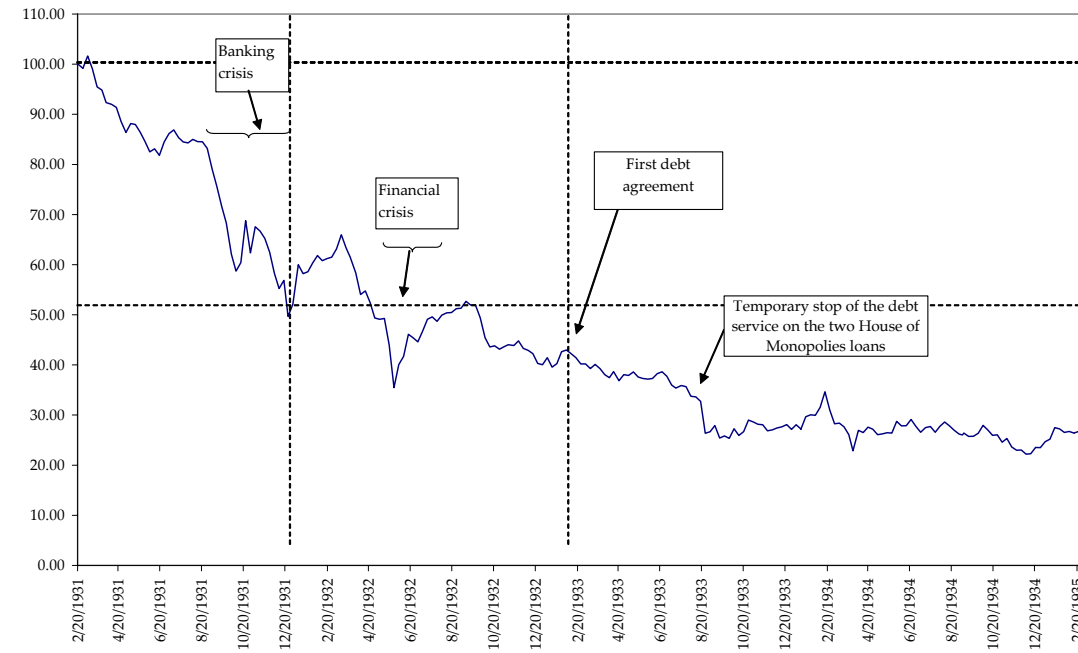
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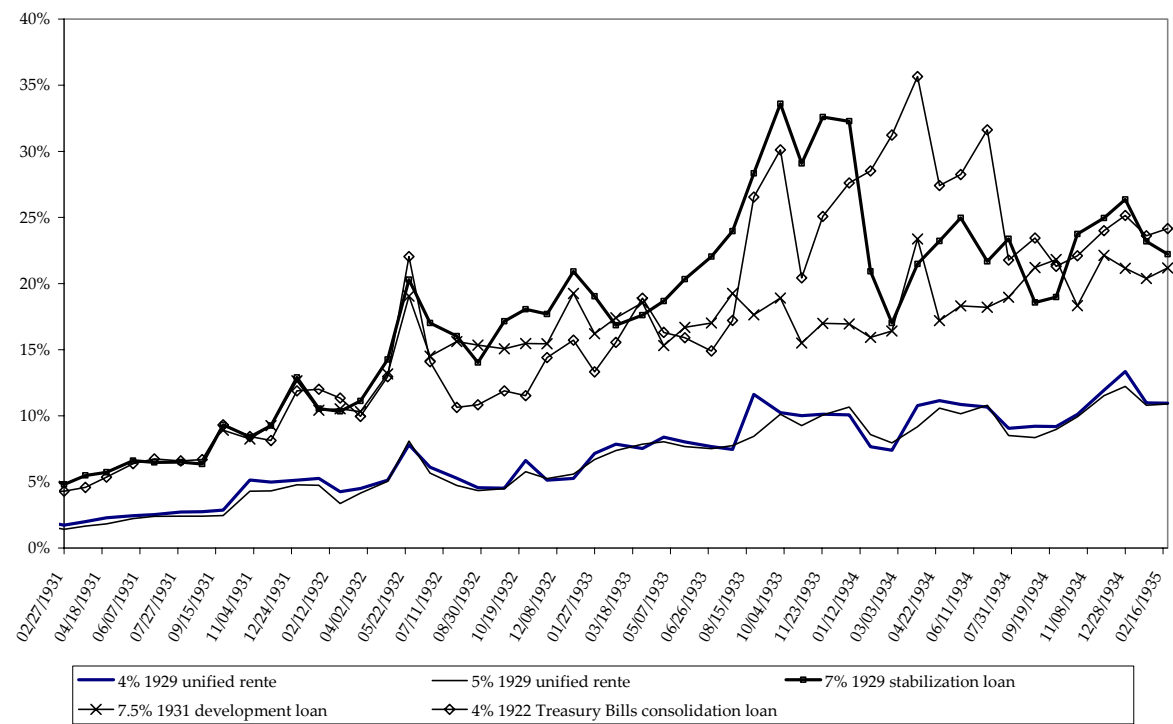
**Figure 1: Evolution of the Russian bonds index and major historical events**



**Figure 2: Evolution of the Romanian bonds index and major historical events**



**Figure 3: Evolution of the Implied Default Probabilities of the Romanian Bonds**



**Table 1: Descriptive statistics for the whole time period (+/- 2 years from the event)**

	INDEX				RETURNS (%)			
	Mean	Standard deviation	Max.	Min.	Mean	Standard deviation	Max.	Min.
<b>Russia (1916-1920)</b>	79.017	17.400	107.536	52.974	-0.377	2.896	10.246	-8.53
<b>Romania (1931-1935)</b>	45.759	21.161	101.613	22.225	-0.628*	4.855	16.467	-21.556

\*Significantly different from zero at 10%.

**Table 2: Descriptive statistics for the period after the crises**

	INDEX <sup>11</sup>				RETURNS (%)			
	Mean	Standard deviation	Max.	Min.	Mean	Standard deviation	Max.	Min.
<b>Russia (1918-1920)</b>	104.044	10.481	121.906	83.843	-0.328	3.55	10.246	-6.958
<b>Romania (1933-1935)</b>	70.442	12.534	100.000	52.367	-0.443	4.734	15.799	-21.397

**Table 3: Financial features of the two bond series**

	ROMANIA	RUSSIA
Currency denomination	Gold standard parity	Assimilated to gold standard parity
Coupon	4 – 7.5 %	4.5 – 5%
Maturity	Long term (>30 years)	Long term (>40 years)
Guaranties	Revenues generated by Government Monopolies and other general fiscal revenues	General fiscal revenues
Negotiations	Uninterrupted (participation of the French bondholders' national association <sup>12</sup> )	Weak, often non existent
Reimbursements and coupons	Periodical (until 1939)	None

<sup>11</sup> Basis 100 on the event date.

<sup>12</sup> ANPFVM (*Association Nationale des Porteurs Français de Valeurs Mobilières*).



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